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Physiotherapy and Occupational Therapy Journal

POTJ

July - September 2020
Volume 13, Number 3

Contents

Original Articles

Original Article

Physiotherapy and Occupational Therapy Journal
Volume 13 Number 3, July- September 2020
DOI: http://dx.doi.org/10.21088/potj.0974.5777.13320.6

Correlation of Stress and Non-Specific Back Pain in High-School Students

Neha Gupta[1], Vrinda Sachdeva[2]

How to cite this article:
Neha Gupta, Vrinda Sachdeva. Correlation of Stress and Non-Specific Back Pain in High-School Students. Physiotherapy and Occupational Therapy Journal. 2020;13(3):109-114.

Abstract

Background: Stress is basically defined as any alteration in homeostasis due to any physical, mental or emotional factor. Back pain is defined as any ache or discomfort occurring at or in and around the areas of spine. Similar to stress, the etiology behind back pain is different in different individuals. The non-specific type of back pain may develop suddenly after lifting some heavy objects, any abnormal body posture if adapted, prolong sitting hours etc. In today's time, with the growing population, the competition is growing as well. The stress that these students are having is very high.This makes a person more prone or susceptible towards any musculoskeletal disorder including non-specific back pain. Over time, acute onset of back pain may turn into chronic back pain. *Methods:* Total 100 subjects were included in the study. Age was limited from 16-20 years of age taking coaching classes. The study was conducted on students living in PG accommodation in Vikas Puri, New Delhi. The stress levels were measured using perceived stress scale. The non-specific back pain (NSBP) levels were measured using Oswestry disability index. *Result:* In this study, correlation was found between the stress and NSBP in high school students. Out of total 100 students, 15 students had minimal stress levels, 55 students had moderate levels of stress while 30 students were having high levels of stress. Out of 100 subjects, 39 students were having minimal pain. 45 students showed moderate level of pain and 16 students were having high pain levels. Correlation between stress and NSBP came out to be 0.41, which showed that psychological factors like stress are responsible for any musculoskeletal disorder like NSBP. Through the results the conclusion can be made that psychological factors like stress have a relation with certain musculoskeletal disorders like NSBP. Since the coaching students have lots of stress due to the rising competition and getting into good college, they end up risking their own health. Due to prolong siting hours, studying in awkward postures makes a person more susceptible to any musculoskeletal disorders.

Keywords: Non Specific Back Pain; Corelation; High School Students

Introduction

Stress is basically defined as any alteration in homeostasis.[1] US stress statistics showed that 77% of people regularly experience physical symptoms due to stress. Response to a stressor depends upon individual to individual. Due to different responses to stress, the physical symptoms may vary from individual to individual. Physical symptoms include fatigue, headache, change in appetite, muscle tension etc. Stress is either acute or chronic. Acute stress cause muscle to tense up while the chronic stress may lead totension related-backpain. Such aches may end up leading to anxiety, irritability, lack of sleep, depression etc.[22]

Similar to stress, the etiology behind back pain is different in different individuals. Muscle tension that is semi contracted state of muscle for prolong time may lead to aches or discomfort in back. Other

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than muscle tension, muscle spasm, disc herniation, any injury, structural deformities are certain causes for back pain. Wrong ergonomic patterns like prolong sitting, abnormal posture, improper lifting techniques have also been a major factor for causing back pain.[3]

It is been studied that 19 out of 20 cases, that are of acute onset can be classified in the category of Non-Specific Back Pain (NSBP). Such type of back pain has been reported by each and every individual at some or the other point in their lives. The reason of calling it as "non-specific" is that it usually doesn't have any underlying pathology or the cause of pain is not clear. Such pain can therefore be dependent upon the individual and also the severity-mild, moderate or severe. Some researchers have studied that the cause of such pain may include minor changes like an over stretch or prolonged stretch of a muscle or any ligament. Even prolong shortening of some muscles acting as antagonist of over stretched muscles may also be a factor for causing such pain. Other factors including the disc herniation, any injury, any facet joint problem or any structural abnormality may also lead to pain. Therefore, such NSBP is usually difficult to diagnosesince there is no specific reason for the pain.

Such type of pain is usually over lower back but may sometimes radiate down to buttock or even the legs. Pain is usually eased by lying down straight or even prone lying which has been seen very effective. Patients with such type of pain usually recovers once the aggravating activities are subsided. The NSBP is also termed as mechanical back pain. Such pain may have an "on-off" type of episodes of pain. Such pain may sometimes take up weeks or months to get subside while ending up into a chronic stage of pain and discomfort. Such type is called as chronic back pain. Discomfort caused by backpain decreases the overall performance of the person. From childhood to adult, people of all ages are suffering from back pain. The discomfort caused by back pain has also seen to affect people activities of daily living. A study conducted in US stated that approx. 149 million work days are lost per year due to back pain.[4]

Coaching institutes have spread enormously, attracting thousands of students for preparation of entrance exams. Such institutes, include long hours of study, prolong sitting hours which leads to a lot of physical stress inflicted on body. Due to the static and awkward postures, stress is placed on our soft tissues.[5] Prolong immobility reduces the blood flow and further leading to muscle tension. This makes a person more prone or susceptible towards any musculoskeletal injury. Over time, if the lifestyle remain same, the person may complain of recurrent episodes of backpain.[6]

There is lack of research that specifically focuses on stress and NSBP. Therefore, this study aims to identify a significant relation between stress and NSBP in high school students. Such data is really useful to prevent our young generations from stress related back pain, also aware them to adapt suitable postures and lifestyle modifications in their daily lives.

Materials and Methods

After obtaining the approval from the coaching students through a consent form. We carried out a correlational study among students of coaching institutes living in PG in Vikas Puri, New Delhi. A total of 100 coaching students participated in the study with 100% response rate. Students were randomly selected and were explained thoroughly about the purpose of the study. The inclusion criteria included all consenting students aged 16-20 years, student who has once/ever experienced back pain, Affluent with English and students taking coaching were only included in this study. We excluded all students with a history of any injury, any spinal disorder including cancer, TB, Neuromuscular disorder or any past back surgery.

2 instruments were used in order to carry out the procedure. Firstly, Perceived Stress Scale (PSS). It is a classical assessment tool that was developed in 1983. This tool basically helps us to measure the degree to which situations in one's life are appraised as stressful.[7] This questionnaire was filled by all the subjects in order to know the level of stress the student is facing; minimum, moderate, high. Second instrument used is Oswestry Disability Index (ODI). It is used to quantify disability related to back pain. It is an important tool that researchers used to measure a patients functional disability. This questionnaire included certain sections like pain intensity, personal care, lifting, sitting, standing, walking, sleeping etc. One option from each section was selected by the subject based on their personal experience. Based on such options a total score was calculated. This score helped us know the intensity of back pain the subject has; minimum, moderate, high.[8]

The participants were given around 20 min to complete both the questionnaires. The questionnaires were checked for completeness at the time of collection, and, if any information was found missing, they were asked again to complete the information.

Data Analysis

The data was collected through 2 questionnaires. One by perceived stress scale and the other one by Oswestry disability index scale. The relation between two of them was analysed by finding the correlation. The data was analysed on basis of categories of the scale which are as follows: For PSS: 0-13 score is Minimum, 14-26 is Moderate and 27-40 is High. For ODI: 0-20 score is Minimal disability, 21-40 is Moderate and more than 41 is severe disability. Correlation test was done between PSS and ODI. The correlation coefficient (r) may range from -1 to +1 in which -1 is a perfect negative correlation while +1 is a perfect positive correlation.

Results

Out of 100 questionnaires administered, 100 were retrieved and were found to be evaluable with a response rate of 100%. Males and females accounted were 38% and 64%, respectively. (Table 1, Fig.1)

Table 1: Ratio of Males and Females in the Study.

Males	Females
36	64

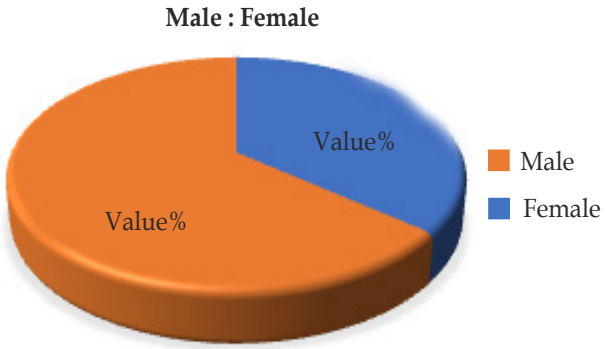

Fig. 1: Ratio of Males and Females in the Study

The respondents age ranged from 16- 20 years of age. The mean age of males = 18.38 years and the mean age of females= 18.73 years. (Table 2, Fig. 2)

Table 2: Mean Age of Students

Mean Age Male	Mean Age Female
18.38	18.73

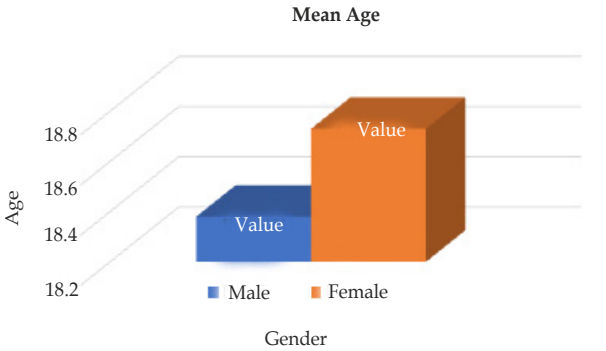

Fig. 2: Mean Age of Students

Out of total 100 students; 15 students showed minimum stress levels, 55 showed moderate and 30 showed high stress levels as per the PSS score. (Table 3, Fig. 3)

Table 3: Perceived Stress Scale Levels in Students

Levels	Minimum	Moderate	High
PSS	15	55	30

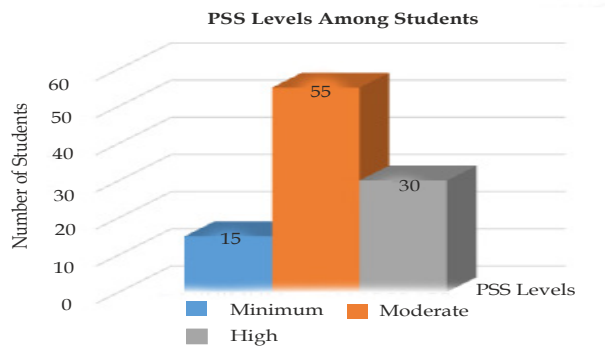

Fig. 3: Perceived Stress Scale Levels in Students

As per the Oswestry disability index questionnaire, it showed out of total 100 students, 39 had minimal disability, 45 had moderate and 16 had high disability.(Table 4, Fig. 4)

Table 4: Oswestry Disability Level in Students

Levels	Minimum	Moderate	High
ODI	39	45	16

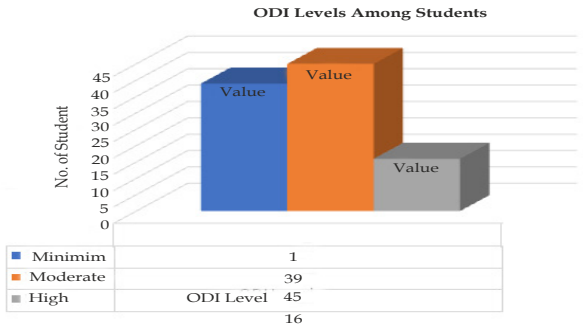

Fig. 4: Oswestry Disability Level in Students

Average PSS score of all 100 high school students is 23.05. The standard deviation of the data is 7.69 (Table 5, Fig. 5)

Table 5: It Represents Average and Standard Deviation of Pss Scores

Scale	Average	Stdev
PSS	23.05	7.69

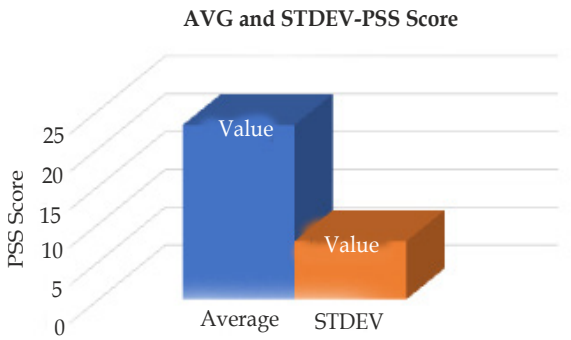

Fig. 5: It Represents Average and Standard Deviation of Pss Scores

Average ODI score of all 100 High School students is 25.18. The standard deviation of data is 15.05(Table 6, Fig. 6)

Table 6: It Represents Average and Standard Deviation of Odi Scores

Scale	Average	STDEV
ODI	25.18	15.05

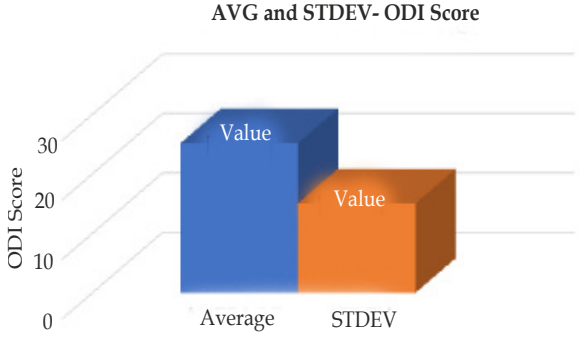

Fig. 6: It Represents Average and Standard Deviation of Odi Scores

Correlation between stress and non specific back pain is 0.41.A total score of stress scale as well as the back pain scale was found. Correlation test was done between the PSS and ODI. The value of correlation depicts that there is relation between stress and non specific back pain. Therefore, the correlation test shows that there is a significant relationship between stress and non specific back pain

Discussion

This study explored the relationship of low back pain with stress in high school students taking coaching. Students in coaching classes have an immense amount of both physical and mental stress due to vast syllabus for clearing entrance exams with good results. Such preparation involves prolong studying hours which involves prolong sitting, abnormal or awkward postures, irregular and unhealthy eating habits and most importantly lack of physical activity.[9] The stress is a risk factor leading to all the habits mentioned above. Due to such habits students are prone to certain musculoskeletal pain. Many students even try to take medical help but most of them usually neglect their symptoms and think of giving such things time after the entrance exams are over.[10]

Due to such high levels of stress, students avoid taking part in any extracurricular activity, which is quiet fine in order to crack entrance with good score. But, students usually forget that certain amount of exercise is required in order to maintain proper equilibrium of the body. This ends up child in prolong immobile state due to continuous studying hours.[11] This prolong immobility further leads to reduction in blood flow. This reduced blood supply further causes the muscle to tense up. Muscle tension further makes a person more susceptible for any musculoskeletal injury. The available literature indicated the link between psychological factors like stress towards back pain. Such acute back pain maybe changed into a chronic one if appropriate measures are not taken.[12]

Ergonomics is basically a branch of science that deals with laws to be followed at working place. The seat on which the student sit or the table height on which the student is studying should be of optimal height. That is an ergonomically designed materials must be used in order to reduce any risk of musculoskeletal injury. One quarter height of the total body height is an optimal height

that must be there in a seat. Seat height must be adjustable so that whether the person is tall or small can be accommodated easily. Cushioned seats have been seen more beneficial than the plastic or any metal ones. Also, the width of the seat must be adequate enough to fit in properly rather than being uncomfortable. Such ergonomic corrections if are made do not completely avoid any injury, but yes they do prevent risk or reduce risk of any musculoskeletal injury. Researchers established that 41 out of 123 subjects had at least one musculoskeletal problems due to work setting factors like stress, prolong working in same position, awkward postures while working which further, eventually leads as a risk factor of musculoskeletal disorder including low back pain.[13]

In this study, correlation was found between the stress and NSBP in high school students. Correlation between stress and NSBP came out to be 0.41, which showed that psychological factors like stress are responsible for any musculoskeletal disorder back pain. Results obtained through the study shows that correlation between the stress and NSBP is 0.41. According to Correlation coefficient Interpretation Guideline, $0.2 \leq |r| < 0.4$ shows weak correlation.[14] Since our study shows a correlation of 0.41 between the stress and low back pain, which further shows that there is a weak correlation between stress and NSBP. The reasons leading to same may include small sample size, certain errors while analysing the data, other factors excluding stress like lack of physical activity, unhealthy lifestyle, improper diet were not included in the study.

Limitations

The sample was selected based on convenience sampling which may affect the generalization of the findings. The sample size was small, thus the result cannot be very reliable. Anthropometric measurements were not being performed which might help us in giving good ergonomic solutions. Age limitation was there.Number of prolong sitting hours, postures were not being assessed.

Future Scope

This study can be used to sensitize the medical professionals about the rising musculoskeletal discomforts that these young adults are facing and the lifestyle modifications required for the same in order to prevent such discomforts as far as possible. Also, these students who are preparing for their future career are indirectly risking their long term health. Such information may also be used by certain health care professionals, which may further help in formation of certain health strategies, further reducing risk of such musculoskeletal disorders in coaching students.

Clinical Significance

The study shows that there is a significant relationship between the stress and NSBP. Correlation was obtained with help of study - 0.41, which is towards the moderate amount of correlation according to Correlation coefficient Interpretation Guideline. This signifies that psychosocial factors like stress are responsible for nonspecific back pain among the individuals.

Conclusion

Through the results the conclusion can be made that psychological factors like stress have a relation with certain musculoskeletal disorders like non-specific back pain. Since the coaching students have lots of stress due to the rising competition and getting into good college, they end up risking their own health. Students sit for a prolong time for studying, have awkward postures, have lack of physical activity. Due to prolong immobility the muscles get tensed up. These factors make a person more susceptible towards any musculoskeletal disorder like low back pain.

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Original Article

Physiotherapy and Occupational Therapy Journal
Volume 13 Number 3, July- September 2020
DOI: http://dx.doi.org/10.21088/potj.0974.5777.13320.7

To Evaluate the Effects of Plantar Fascia and Tendo Achilles Stretch in Chronic Plantar Fasciitis

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How to cite this article:
Monika Sharma, Sanjai Kumar. To Evaluate the Effects of Plantar Fascia and Tendo Achilles Stretch in Chronic Plantar Fasciitis. Physiotherapy and Occupational Therapy Journal. 2020;13(3):115-122.

Abstract

Objectives: Plantar fasciitis (PF) is a degenerative syndrome of the plantar fascia resulting from repeated trauma at its origin on the calcaneus.[5] PF is reported to be the most common cause of inferior heel pain in adults.[6] Overload causes micro-tears at the fascia-bone interface of the calcaneus or within the substance of the plantar fascia alone. The central band of the plantar fascia is primarily affected where a hyper cellular, inflammatory response occurs within the fibres of the fascia, leading to degenerative changes. The site of abnormality is typically near the site of origin of the plantar fascia at the medial tube rosity of the calcaneus. The objective of this study is to evaluate the effectiveness of plantar fascia and Tendo Achilles stretch in chronic plantar fasciitis patients. *Methods* : A sample of 30 subjects, age between 25-35 years, both male and females, as per inclusion and exclusion criteria, from SSSMC and and Dr. K.K.B.M. Subharti Hospital, Dehradun and OPD of Physiotherapy, School of Medical and Allied Sciences, Greater Noida were included in the study. The subjects were randomly divided into two groups. The subjects were assessed and there Pre VAS and S.D. was recorded (during first few steps in morning) and then Group – A was treated with plantar fascia stretching and the calf massage and Group- B was treated with Tendo Achilles stretching and the calf massage. After 8 weeks Post VAS and S.D. was again recorded and compared. *Results:* The data of Pre VAS Score, Post VAS Score and S.D. for both Group (A and B), was recorded on the base of pain on first walking in the morning on day 1st and after 8th week. The detailed statistical analysis shows the improvement in both the Groups A and B. The overall more improvement was found in the Group- A in which planter fascia stretching with calf muscle massage was delivered to the patients. Which shows the significant improvement in chronic plantar fasciitis subjects. The mean scores of Pre VAS and S.D. and Post VAS and S.D. of Group - A, was 5.46 ± 1.02 and 0.93 ± 0.57 and the mean scores of Pre VAS and S.D. and Post VAS and S.D. of Group - B, was 5.27 ± 0.99 and 1.86 ± 0.71 on day 1st and after at 8th week respectively. The paired "t" test was applied to test the significant difference between day 1st and after at 8th week. A significant P - Value of <.001* was found in both the Groups A and B when the comparison was done with the mean score of pre VAS and S.D. and post VAS and S.D. on after at 8th week. Which shows the significant improvement in pain in both the groups but improvement in pain was more in Group-A than the Group-B to whom the tissue specific stretching of Planter fascia was given with the calf massage in Chronic Planter Fasciitis subjects. *Conclusions:* The results of this study indicates that there is significant improvement in the VAS score of the Group –A and B. But the results of the Group A was more effective than the group B to whom the tissue specific stretching of planter fascia was given with the calf massage.

Keywords: Plantar fascia; Plantar fasciitis; Tendo Achilles stretch; Plantar Fascia stretch; Plantar Fascia Massage; VAS; Windlass mechanism.

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Introduction

Underlying the skin of the sole there is a thick layer of deep fascia known as plantar aponeurosis (commonly called as plantar fascia) which originates from the medial calcaneal tuberosity. It consist of central, medial, and lateral parts. The medial and lateral parts are relatively thin, and

the central part is thickest and strongest. Traced distally the aponeurosis broadens and divided into five processes, one for each digit.[1]

The plantar fascia is one of the major stabilizing structures of the longitudinal arch of human foot, especially during midstance of the gait cycle.[2] The foot has a visible medial longitudinal arch (MLA) that aids in distributing the force attributed to weight bearing. The MLA connected at their base by the plantar fascia. When force is applied to the apex of the MLA, the arch depresses, and tension is distributed throughout the plantar fascia.[3,4] The plantar fascia contributes to support of arch of the foot by acting as a tie-rod, where it undergoes tension when the foot bears weight. (Fig. 1)

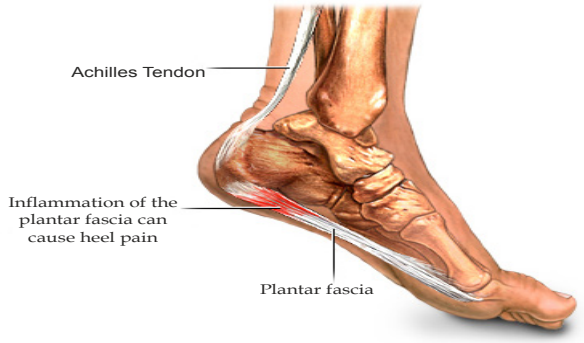


Fig. 1: Plantar fasciitis**:**

It was found the plantar fascia continuously elongated during the contact phase of gait. It went through rapid elongation before and immediately after mid-stance, reaching a maximum of 9% to 12% elongation between mid-stance and toe-off. During this phase the plantar fascia behaves like a spring, which may assist in conserving energy. In addition, the plantar fascia has a critical role in normal mechanical function of the foot, contributing to the "windlass mechanism". When the toes are dorsiflexed in the propulsive phase of gait, the plantar fascia becomes tense, resulting in elevation of the longitudinal arch and shortening of the foot.

Plantar fasciitis is irritation of the plantar fascia. Plantar fasciitis (PF) is a degenerative syndrome of the plantar fascia resulting from repeated trauma at its origin on the calcaneus[5] PF is reported to be the most common cause of inferior heel pain in adults.[6] Overload causes micro-tears at the fascia-bone interface of the calcaneus or within the substance of the plantar fascia alone. The central band of the plantar fascia is primarily affected where a hypercellular, inflammatory response occurs within the fibres of the fascia, leading to degenerative changes. The site of abnormality is typically near the site of origin of the plantar fascia at the medial tuberosity of the calcaneus.[7] Suggested risk factors include overweight, prolonged standing, and having a reduced range of motion in the ankle and 1st metatarsophalangeal joint.[8] (Fig. 2)

On examination, the patient exhibits point tenderness over the bottom of the heel as well as pain with dorsiflexion of the foot. Radiographs often are normal.[9]

Physical therapy is widely used to treat Plantar Fasciitis. It can include passive modalities and active therapy. Treatment consists of stretching of calf muscle and tissue-specific plantar fascia-stretching. Long-term benefits of the stretch include a marked decrease in pain and functional limitations and a high rate of satisfaction. This approach can provide the health-care practitioner with an effective, inexpensive, and straightforward treatment protocol.[10]

With this study we compare the effect of tissue specific plantar fascia stretch over Tendo Achilles on the pain relief and symptoms in chronic plantar fasciitis. (Fig. 3)

Objectives of the Study

Statement of study : Is the plantar fascia stretching with calf massage and Tendo Achilles stretching with calf massage to relive the pain in chronic plantar fasciitis?

Hypothesis

Alternate Hypothesis: There will be a significant difference in VAS score of with plantar fascia stretching with calf massage and Tendo Achilles stretching with calf massage in chronic plantar fasciitis subjects.

Null Hypothesis: There will not be a significant difference in VAS score of with plantar fascia stretching with calf massage and Tendo Achilles stretching with calf massage in chronic plantar fasciitis subjects.

Operational Definitions

a. *Plantar fasciitis:* Plantar fasciitis (PF) is an overuse injury resulting from repetitive

microtears of the plantar fascia at its origin at the tuberosity of the oscalcis deep to the distal medial heel pad.[5]

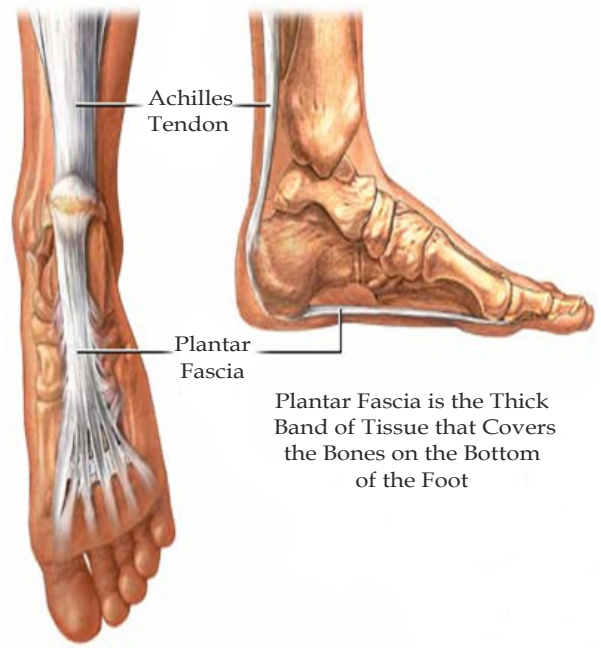


Fig. 2 : Plantar Fascia is the Thick Band of Tissue that Covers the Bones on the Bottom of the Foot

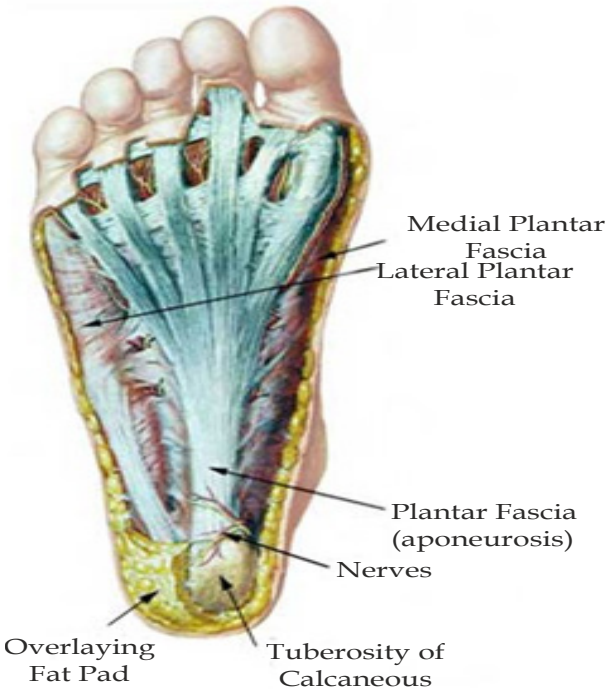


Fig. 3: The plantar fascia is a thick band of connective tissue that supports the foots plantar

The condition presents with tenderness over the midportion of the plantar fascia as opposed to insertional plantar fascia; dorsiflexion of the toe almost always exacerbates the patient's symptoms.[7]

b. *Stretching:* Any movement that require moving a body part to the joint at which there is an increase in the movement of a joint can be called a stretching exercise. Stretching can be done either actively or passively.[10,11]

c. *Massage or Soft Tissue Manipulation:* The scientific manipulation of the body tissue is referred as massage. Any technique, be it manual or mechanical, which imparts mechanical energy to the soft tissue of the body through the skin without producing any change in the position of the joint, in order to elicit certain physiological or psychological effect which can be utilized for therapeutic, restoration or preventive purpose either on sick or a healthy individual can be define as massage.[3]

d. *Visual Analog Scale (VAS):* The Visual Analog Scale, more commonly referred to as the VAS was used to track progress. The VAS is a scale used as a subjective measurement of pain experienced on a level between zero and 10 with zero being no pain and 10 being the worst. The VAS is a well-studied method for measuring both acute and chronic pain (Scott, 1976), and its usefulness has been validated by several investigators (Katz, 1999 and Carlson, 1983). The patient is asked to bisect the line at a point representing self-assessed position on the scale. The patient score is thus obtained by measuring from zero to mark bisecting the line.

Materials and Methods

30 patients (both males and females) of age between 25-35 years (mean age of 29.60) presenting with signs and symptoms of plantar fasciitis from duration of 8 weeks or more and willing to participate, were evaluated in this study. The inclusion criteria of selection was age (25-35 years), symptoms of plantar fasciitis (first few step are painful in morning, pain on medial aspect of heel) with normal MMT of dorsi-flexors and plantar-flexors. The subjects who were on medication for pain relief or having other associated joint and heel pathology were excluded from the study.

30 subjects were randomly divided in two groups Group A and Group B (15 subjects each). Group A was instructed to do plantar fascia stretching twice a day and calf muscle massage was given once for 6 days/week for 8 weeks. Group B was instructed to do Tendo Achilles stretching twice a day and calf muscle massage was given once for 6 days/week for 8 weeks. All the subjects were instructed to do

stretching once just prior to get off the bed before the first step in the morning and again during their treatment in OPD. Massage was given in OPD after the stretching.

The outcome measures of the study was VAS according to the patient's relief in pain and symptoms. The subjects were evaluated prior to the commencement of the treatment at day 1 and after every week till 8 weeks by using VAS as the outcome measure. The VAS of day 1 and VAS after 8 weeks of giving treatment were compared.

Photo 1: Patient Performing Plantar Fascia Stretching

Photo 2: Patient Performing Plantar Fascia Stretching

Photo 3: Patient Performing Tendo Achilles Stretching (Starting Position)

Photo 4: Patient Performing Tendo Achilles Stretching (Stretched Position)

Photo 5: Patient Performing Tendo Achilles Stretching (Starting Position)

Photo 6: Patient Performing Tendo Achilles Stretching (StretchedPosition)

All the analysis was obtained using SPSS Version 13.0 (for window vista). Demographic data of the patients including age and gender were summarized. The dependent variable for the statistical analysis was VAS (for pain). A base line data was taken at the beginning of the study (pre test values) and after the completion of the treatment (post test values) to analyze the difference between the two treatment groups, independent t – test was

used. A level of 0.05 was used to determine the statistical significance.

Design : This study is a comparative study design which intends to find out if there is any significant improvement in the pain during first few steps in the morning in both the Groups-A and B, having physiotherapy treatment protocol, Group-A receive plantar fascia stretching with calf massage while Group-B receive Tendo Achilles stretching with calf massage within the sample.

Sample : A sample of 30 subjects, age between 25-35 years, both male and females, were included in the study from SSSMC, Dr. K.K.B.M. Subharti Hospital, Dehradun and OPD of Physiotherapy, School of Medical and Allied Sciences, Greater Noida. All the subjects were assessed for inclusion and exclusion criteria of the study.

Sample Selection : Sample selection was done as per availability of Chronic Planter Fasciitis patient who were able to continue treatment regularly.

A baseline assessment of clinical and functional status was assessed before the subjects were assigned to do the task as per protocol.

Inclusion Criteria

- Age 25-35 years.
- Symptoms of plantar fasciitis are present.
- Normal muscle power.
- Normal blood pressure.
- Pain on medial aspect of heel.
- Willingness to participate.

Exclusion Criteria

- Age below 25 or above 35 years.
- Any joint and heel pathology.
- Medication for pain.
- Any foot injury in previous one year or any foot deformity.
- Professional athlete.
- Inability to understand instruction or to provide informed.

Instrumentation

1. Patient couch
2. Stationary: (pen, paper, graph paper, marker)
3. Universal Goniometer (halfcircle)
4. Golf ball
5. Towel
6. Chair
7. Oil or talcum powder: Friction reducing agent or lubricating agent.
8. VAS Scale

Fig. 4: Universal Goniometer (half circle)

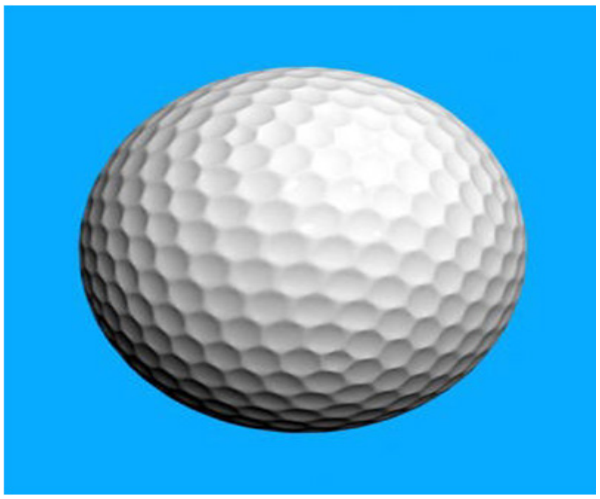


Fig. 5: Golf Ball

Protocol and Procedure

This study was done on 30 subjects with the signs and symptoms of Chronic Plantar Fasciitis from duration of 2 months or more. All subjects between 25-35 years of age were randomly selected. The subjects who were on medication for pain relief

were excluded from the study. All subjects were randomly divided in two groups Group A and amp; Group B (15 subjects each). Group A was instructed to do Plantar Fascia stretchings twice a day and calf muscle massage was given once for 6 days/week for 8 weeks. Group B was instructed to do Tendo Achilles stretchings twice a day and calf muscle massage was given once for 6 days/week for 8 weeks. All the subjects were instructed to do stretching once just prior to get off the bed before the first step in the morning and again during their treatment in OPD. Massage was given in OPD after the stretching. The subjects were evaluated prior to the commencement of the treatment and after every week till 8 weeks by using VAS as the outcome measure.

Duration : The treatment of stretching was given twice a day and the calf massage was given once a day for 8th week under the supervision of a Physiotherapist. Both the Groups have given same few techniques.

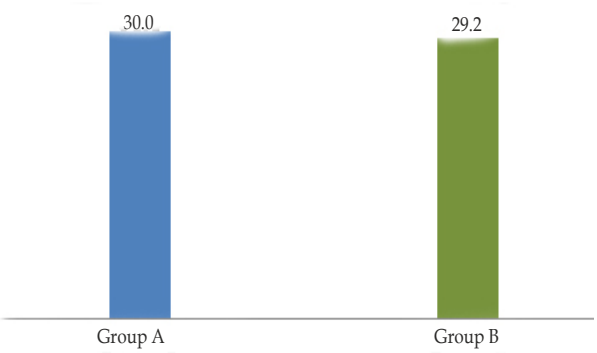
Data Analysis : The data of Pre and Post VAS Score for both Group (A and B), was recorded on the base of pain on first walking in the morning on day 1st and after 8th week. The detailed statistical analysis shows the improvement in both the Groups A and B. The overall more improvement was found in the Group- A in which planter fascia stretching with calf muscle massage was delivered to the patients. Which shows the significant improvement in Chronic Plantar Fasciitis subjects. The mean scores of Pre VAS and S.D. and Post VAS and S.D. of Group-A, was 5.46 ± 1.02 and 0.93 ± 0.57 and the mean scores of Pre VAS (Table 2 and Graph 2) and S.D. and Post VAS and S.D. of Group-B, was 5.27 ± 0.99 and 1.86 ± 0.71 on day 1st and after at 8th week.(Table 4 and Graph 4) The paired "t" test was applied to test the significant difference between day 1st and after at 8th week. A significant P - Value of <.001* was found in both the Groups A and B when the comparison was done with the mean score of pre VAS and S.D. and post VAS and S.D. on after at 8th week. Which shows the significant improvement in pain in both the groups but improvement in pain was more in Group-A than the Group-B to whom the tissue specific stretching of Planter fascia was given with the calf massage in Chronic Planter Fasciitis subjects.

Results

The results of this study shows that the mean scores of Pre VAS and S.D. and Post VAS and S.D. of Group-A, was 5.46 ± 1.02 and 0.93 ± 0.57 and the mean scores of Pre VAS and S.D. and Post VAS and S.D. of Group-B, was 5.27 ± 0.99 and 1.86 ± 0.71 on day 1st and after at 8th week respectively. The paired "t" test was applied to test the significant difference between day 1st and after at 8th week. A significant P - Value of <.001* was found in both the Groups A and B when the comparison was done with the mean score of pre VAS and S.D. and post VAS and S.D. on after at 8th week. Which shows the significant improvement in pain in both the groups but improvement in pain was more in Group-A than the Group-B to whom the tissue specific stretching of Planter fascia was given with the calf massage in Chronic Planter Fasciitis subjects. (Table 3 and Graph 3)

Table 1: Mean Age of Group A and Group B

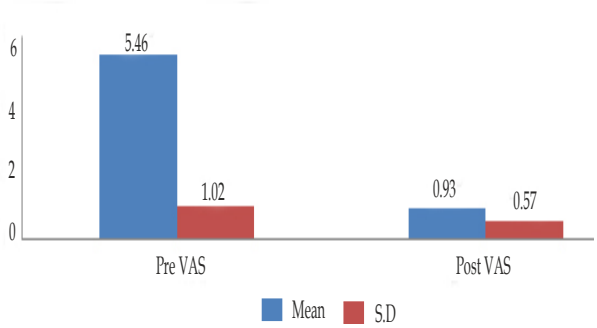
Variable	Mean	SD	SEM	t-value	p-value
Group A	30.0	3.54	0.646	0.984	0.329
Group B	29.2	2.7	0.492		



Graph 1: Mean Age of Group A and B

Table 2: Comparison of Effect of Plantar Fascia Stretch between Pre and Post VAS of Group A (Plantar Fascia stretch)

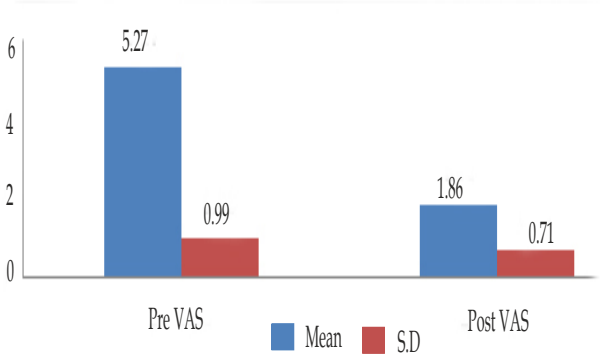
Relative Improvement	MEAN	S.D	S.E.M	t-value	p-value
Pre VAS	5.46	1.02	0.186	21.23	<0.001
Post VAS	0.93	0.57	0.104		



Graph 2: Comparison of Effect of Planter Fascia Stretch between Pre and Post VAS of Group A (planter fascia stretch)

Table 3: Comparison of Pre and Post VAS of Group B (T A Stretch)

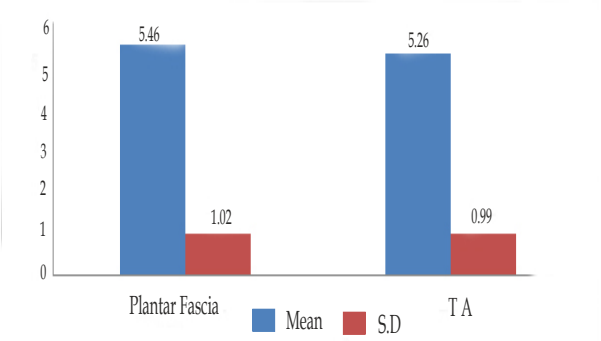
Relative Improvement	MEAN	S.D	S.E.M	t-value	p-value
Pre VAS	5.27	0.99	0.180	15.33	<0.001
Post VAS	1.86	0.71	0.129		



Graph 3: Comparison of Pre and Post VAS of Group B (TA stretch)

Table 4: Comparison of Effect of Planter Fascia Stretch and TA Stretch.

Difference	MEAN	S.D	S.E.M	t-value	p-value
Plantar Fascia	5.46	1.02	0.186	0.771	0.444
T A	5.26	0.99	0.181		



Graph 4: Comparison of effect Plantar Fascia Stretch and TA Stretch.

Discussion

In this study 30 subjects with a age group of 30-55 years were selected. For better comparative analysis of the treatment technique the subjects were divided into two groups, Group A and B, 15 in each. As an outcome measure the subject of both the groups were monitored for Pre Vas score on the base of pain on first walking in the morning.

For Group-A subjects, the treatment protocol includes the plantar fascia stretching with calf massage and for Group - B subjects, the treatment protocol includes Tendo Achilles stretching with calf massage. t - Test has been performed to analyze the comparative study of the treatment of Chronic Planter Fasiitis.

The results supported the randomized controlled trial and research of Di Giovanni et al compared the efficacy of plantar fascia stretching versus Achilles tendon stretching with the other technique of physiotherapy treatment to cure the problem. But it is now cleared from the comparative study done with the help of the plantar fascia stretching with calf massage the prognosis rate is more than that with Tendo Achilles stretching with calf massage in Chronic Planter Fasciitis subjects.

Future Research

It would be more challenging if the study will be done for longer duration and the number of subjects will be more than the better conclusion can be made regarding the effectiveness of treatment protocol.

For better results advance regime of Protocol can be included in the study.

Study could be done in early and late age groups depending on the environmental and habitual facts.

Conclusions

The results of this study indicates that there was a significant improvement in the Pre VAS Score values in both the Groups-A and B. Group-A receive plantar fascia stretching with calf massage while Group-B receive Tendo Achilles stretching with calf massage. But the prognosis rate is more in plantar fascia stretching with calf massage than the Tendo Achilles stretching with calf massage in Chronic Planter Fasciitis subjects.

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Original Article

Physiotherapy and Occupational Therapy Journal
Volume 13 Number 3, July- September 2020
DOI: http://dx.doi.org/10.21088/potj.0974.5777.13320.8

Effectiveness of Mulligan Taping on Pain, Grip Strength and Function in Lateral Epicondylitispatient: An Experimental Study

Ketki Choudhari Ingole[1], Asma Sharma Keshri[2], Meghana R Palkhade[3]

How to cite this article:

Ketki Choudhari Ingole, Asma Sharma Keshri, Meghana R Palkhade. Effectiveness of Mulligan Taping on Pain, Grip Strength and Function in Lateral Epicondylitispatient: An Experimental Study. Physiotherapy and Occupational Therapy Journal. 2020;13(3):123-132.

Abstract

This experimental study design investigated the effect of Mulligan taping on patients diagnosed with lateral epicondylitis who were treated with Mulligan mobilization and conventional therapy (Ultrasound therapy and Stretching). A total of 40 patients aged between 25 to 55yrs were randomly assigned in two groups. Group A - Experimental group n=20 receiving Mulligan taping, Mulligan mobilization and conventional therapy & Group B - Control group n= 20 receiving Mulligan mobilization and conventional therapy alone)

Both the groups received 10 treatment sessions for two weeks. Baseline measurements of 3 outcome measures NPRS (Numerical pain rating scale), Grip strength and functional activity were taken on day 1,5 and 10. Intra group analysis showed that both the groups had statistically significant improvement in NPRS score, Grip strength and functional performance, but inter group analysis showed group A receiving Mulligan taping had statistically significant improvement in all three outcome measures as compared to Group B. Study concludes that Mulligan taping when given in addition with Mulligan mobilization & conventional therapy gives more significant improvement in pain, grip strength and functional status in patients with lateral epicondylitis as compared to, when treated with Mulligan mobilization and conventional therapy alone.

Keywords: Lateral epicondylitis, Mulligan Mobilization with Movement, Mulligan taping, Conventional therapy, Grip strength, Numerical pain rating score, Functional pain status score.

Abbreviations - Lateral Epicondylitis (LE), Mulligan Mobilization with Movement (MWM), Grip Strength, Numerical Pain Rating Score(NPRS), Functional Pain Status Score (FPSS)

Introduction

Lateral epicondylitis is one of the commonest lesion of arm and was first described in by Runge in 1873.[1] The term lateral epicondylitis or tennis elbow is widely used to describe an overuse injury causing tendinitis of the extensor carpi radialis brevis (ECRB) that is characterized by pain and tenderness over the lateral epicondyle.[2] The term tennis elbow is a misnomer since it occurs in non-tennis players also.[3] There are numerous intrinsic and extrinsic factors causing lateral epicondylitis microtrauma caused due "repetitive strain injury", when muscles are overloaded than the load they can withstand or flexibility deficiencies in the forearm extensor muscle or inadequate forearm extensor power and endurance to withstand normal, forceful repetitive movements placed against forearm extensors.[4]

Recently, researchers have come to prefer the term tendinosis.[5,6] Physical examination will confirm tenderness over the common extensor tendon origin often localized to the extensor carpi radialis brevis. Isokinetic strength deficits may also be observed.[2,6] The grip becomes weak probably due to voluntary diminution of effort to avoid undue pain., sometimes wasting of the affected muscles is also seen in long standing cases.[7] Many traditional

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interventions have been used to treat this condition, including non-steroidal anti-inflammatory drugs, corticosteroid injection;[8,9] cryotherapy in the acute stage followed by heat in the more chronic stage,[10] friction massage, rest;[10,11] ultrasound (US); [12] laser,[13] counterforce bracing[14,15] lateral extensor release,[16] progressive strengthening; and stretching exercise therapy.[17] As Garret et al. (2000)[18] concluded that "the traditional modalities of physiotherapy fail specifically to improve the quality of collagen in tendons or bring in new vascularity to promote tissue healing," new treatment measures must be studied for better treatment plan.

Mobilization with movement (MWM) is a type of joint mobilization developed by Brian Mulligan.[19] Mulligan's original theory for the effectiveness of an MWM is based on the concept related to a 'positional fault' that occur secondary to injury and lead to maltracking of the joint causing restrictions in physiological movement resulting in symptoms such as pain, stiffness or weakness (Mulligan, 2004). MWM's correct this by repositioning the joint causing it to track normally minimizing the compressive forces generated by that movement.[19]

Taping is one of the treatment techniques used in Physiotherapy. The basic rational for taping is to provide protection and support to an injured part while permitting optional functional movement. As essential rehabilitation tool, taping enhances healing, by allowing early activity within careful controlled ranges. It permits an early return to daily activities by protecting the area from further injury and avoiding compensatory injury elsewhere.[20]

Brian Mulligan has proposed taping techniques for various dysfunctions. It is effective in pain relief by maintaining the correction of the position fault thus limiting harmful movement and allowing pain free functional movement. so, it prevents further injury of involved structures enhancing its healing process. Maximum studies of Mulligan taping were done with adjunct with its Mulligan mobilization with movement in lateral epicondylitis but very few studies had been done on clinical efficacy of Mulligan taping.[19]

So, our purpose of study was to evaluate the effect of Mulligan taping when given along with Mulligan mobilization with movement and conventional therapy in the treatment of lateral epicondylitis in terms of pain and grip strength and functional activities.

Methodology

40 patients including both male and female aged 25 to 55yrs diagnosed with lateral epicondylitis by Orthophysicians who were send to physiotherapy department for treatment were included in study and were randomly assigned into two groups, Experimental group A (n= 20) and control group B(n=20). Patients with history of trauma, surgery, previous acute infection of elbow or patients who have undergone steroid injection within last 30 days were excluded from study. Patient with cervical spine dysfunction, radial tunnel syndrome or posterior interosseous nerve syndrome were also excluded. After detail explanation of nature of study, informed consent was obtained from all the patients who volunteered for the same. Patient were assessed for 3 outcome measures. Pain, grip strength and functional status.

Pain were assessed using Numerical pain rating scale where21

0 = No Pain

1-3 = Mild Pain (nagging, annoying, interfering little with ADLs)

4-6 = Moderate Pain (interferes significantly with ADLs)

7-10 = Severe Pain (disabling; unable to perform ADLs)

Grip strength was assessed with Hand dynamometer. A standard position for testing recommended by American society of hand therapist was used[22,23]

Fig. 1: Position of Hand while testing hand grip strength.

Functional status of the patient was assessed by Functional Pain Scale[24] Score –

0: no discomfort

1: slight discomfort

2: moderate discomfort

3: Quite a bit discomfort

4: Extreme discomfort

Activities given were as follows and score was recorded

- Usual work, housework or school activities.
- Usual hobbies, sporting or recreational activities
- Using tools or appliances
- Self-dressing
- Squeezing or gripping an object
- Opening doors with the involved limb.
- Activities such as sweeping or raking.
- Carrying a small suitcase with the involved limb.
- Opening a jar or can
- Writing or using a keyboard

The physical functions were tested using a functional pain scale, the patients were asked to perform above listed 10 activities. Subjects were asked to rate intensity of their pain from 0-4 accordingly in each activity. Maximum possible score on this scale can be 40. (Fig. 1)

Mulligans mobilization technique: Mulligan mobilization was given to both the groups with patient lying in supine position with elbow extended and forearm pronated. Distal humerus of the patient was stabilized by the therapist and therapist gave lateral glide to proximal forearm with webspace of another hand. Patient was asked to perform, the pain producing movement (such as gripping or wrist extension) during glide procedure . When glide is applied correctly, the patients will not complain of any pain. The dosage was 10 MWM in one set, 2 sets per session were given and a total of 10 sessions were completed in 2 weeks.[19] (Fig. 2)

Fig. 2: Mulligan Mobilization for Tennis elbow**.**

Mulligans taping technique: Mulligan taping treatment was given only to group A (experimental group) after receiving MWM treatment session. Kinesio tape was used for taping. Skin was shaved and cleaned with spirit prior the tape application. Subject was made to lie down on a plinth and tape is placed around elbow joint over extensor carpi radialis muscles, when the elbow is in slight flexion and forearm in pronation. At the beginning of taping, lateral gliding of extensor group muscles was done and then tape was applied over it maintaining the glide.[19] (Fig. 3)

Fig. 3: Mulligan taping maintaining lateral glide.

Fig. 4: Post Taping.

Both experimental and control groups were given Ultrasound at the intensity of 1W/Cm2 for the period of 5 min. Both groups were taught a self-stretching exercise regime. The wrist extensors were stretched in standing position by the patient with the shoulder flexed to 90˚, elbow extended, and the opposite hand pulling the wrist into flexion with stretch held for 30 seconds. It was done twice a day, three repetitions were performed and a 30-second rest between repetitions was allowed. (Fig. 4)

Assessment for NPRS, grip strength and functional pain scale score was recorded on 1st ,5th and 10th day of treatment.

Result

Table 1 : Distribution of age and gender.

	Experimental group (A)	Control group (B)	p value
Number of subjects, n= 40	20	20	
Mean age (yrs)	40.35	38.70	0.09NS p>0.05
Male/ female	12/8	9/11	0.34 NS p>0.05

Table 2: Intra group comparision of pain on NPRS in group A at 1st ,5th and 10th day.

Descriptive Statistics

	Mean	N	Std. Deviation	Std. Error Mean
1st Day	6.80	20	1.05	0.23
5th Day	5.15	20	0.98	0.22
10th Day	2.60	20	0.99	0.22

Student's paired t test

	Paired Differences					t	df	p-value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
1st Day - 5th Day	1.65	0.48	0.10	1.42	1.87	15.07	19	0.000 S,p<0.05
1st Day – 10th Day	4.20	0.52	0.11	3.95	4.44	35.90	19	0.000 S, p<0.05
5th Day – 10th Day	2.55	0.60	0.13	2.26	2.83	18.85	19	0.000 S, p<0.05

Table 3: Intra group Comparison of pain on NPRS in group B at 1st ,5th and 10th day.

	Mean	N	Std. Deviation	Std. Error Mean
1st Day	6.45	20	1.05	0.23
5th Day	3.75	20	1.40	0.31
10th Day	1.50	20	1.19	0.26

Student's paired t test

	Paired Differences					t	df	p-value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
1st Day - 5th Day	2.70	0.73	0.16	2.35	3.04	16.48	19	0.000 S,p<0.05
1st Day – 10th Day	4.95	0.60	0.13	4.66	5.23	36.60	19	0.000 S,p<0.05
5th Day – 10th Day	2.25	0.55	0.12	1.99	2.50	18.29	19	0.000 S,p<0.05

Table 4: Intra group Comparison of grip strength in group A at 1st, 5th and 10th day.

	Mean	N	Std. Deviation	Std. Error Mean
1st Day	23.40	20	3.39	0.75
5th Day	23.85	20	5.99	1.34
10th Day	23.90	20	1.44	0.32

Student's paired t test

	Paired Differences					t	df	p-value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
1st Day - 5th Day	-0.45	3.80	0.85	-2.23	1.33	0.529	19	0.603 NS,p>0.05
1st Day - 10th Day	-0.50	3.20	0.71	-1.99	0.99	0.698	19	0.494 NS,p>0.05
5th Day - 10th Day	-0.05	5.51	1.23	-2.62	2.52	0.041	19	0.968 NS,p>0.0

Table 5: Intra group Comparison of grip strength in group B at 1st ,5th and 10th day.

Descriptive Statistics

	Mean	N	Std. Deviation	Std. Error Mean
1st Day	24.50	20	2.41	0.54
5th Day	24.90	20	2.38	0.53
10th Day	25.75	20	3.52	0.78

Student's paired t test

	Paired Differences					t	df	p-value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
1st Day - 5th Day	-0.40	1.81	0.40	-1.25	0.45	0.98	19	0.338 NS,p>0.05
1st Day – 10th Day	-1.25	3.19	0.71	-2.74	0.24	1.75	19	0.096 NS,p>0.05
5th Day – 10th Day	-0.85	2.34	0.52	-1.94	0.24	1.62	19	0.122 NS,p>0.05

Table 6: Intra group Comparison of Functional Pain Scale in group A at 1st ,5th and 10th day.

Descriptive Statistics

	Mean	N	Std. Deviation	Std. Error Mean
1st Day	25.60	20	5.66	1.26
5th Day	21.15	20	5.49	1.22
10th Day	15.30	20	5.34	1.19

Student's paired t test

	Paired Differences					t	df	p-value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
1st Day - 5th Day	4.45	1.66	0.37	3.66	5.23	11.92	19	0.000 S,p<0.05
1st Day – 10th Day	10.30	2.29	0.51	9.22	11.37	20.05	19	0.000 S,p<0.05
5th Day – 10th Day	5.85	1.87	0.41	4.97	6.72	13.97	19	0.000 S,p<0.05

Table 7: Intra group Comparison of Functional Pain Scale Score in group B at 1st ,5th and 10th day.

Descriptive Statistics

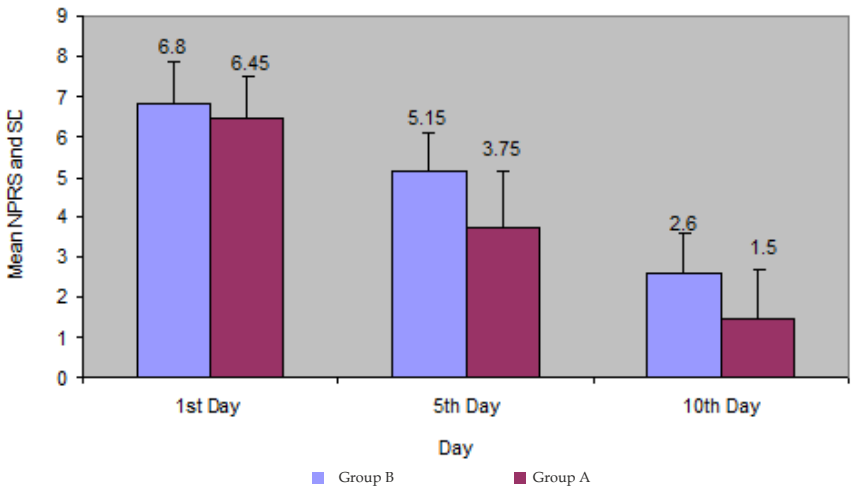
	Mean	N	Std. Deviation	Std. Error Mean
1st Day	19.95	20	6.24	1.39
5th Day	15.60	20	6.07	1.35
10th Day	10.05	20	5.86	1.31

Student's paired t test

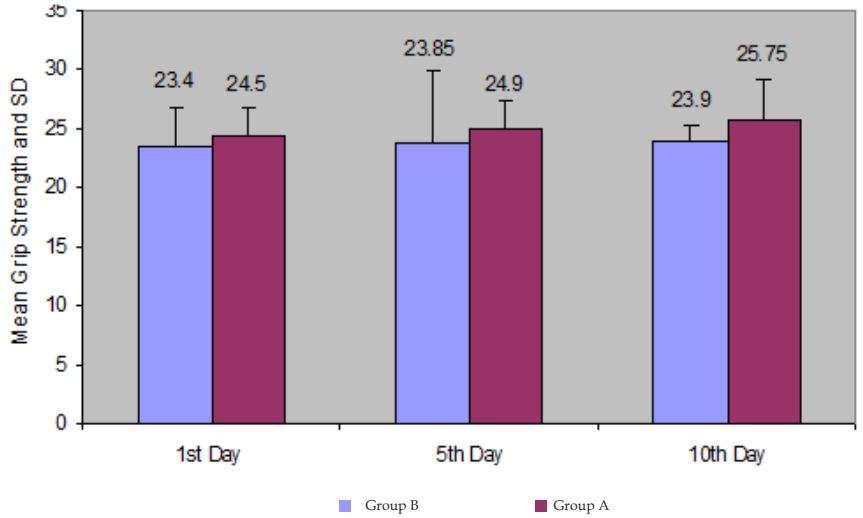
	Paired Differences					t	df	p-value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
1st Day - 5th Day	4.35	1.34	0.30	3.71	4.98	14.42	19	0.000 S,p<0.05
1st Day – 10th Day	9.90	2.84	0.63	8.56	11.23	15.56	19	0.000 S,p<0.05
5th Day – 10th Day	5.55	2.18	0.48	4.52	6.57	11.34	19	0.000 S,p<0.05

Inter group comparison data

Graph 1: Inter group Comparison of pain on NPRS in both the groups A and Bat 1st 5th and 10th day.



Graph 2: Inter group Comparison of grip strength in both the group A and B at 1st ,5th and 10th day.



Graph 3: Inter group Comparison of Functional Pain Scale in both the groups A and B at 1st 5th and 10th day.

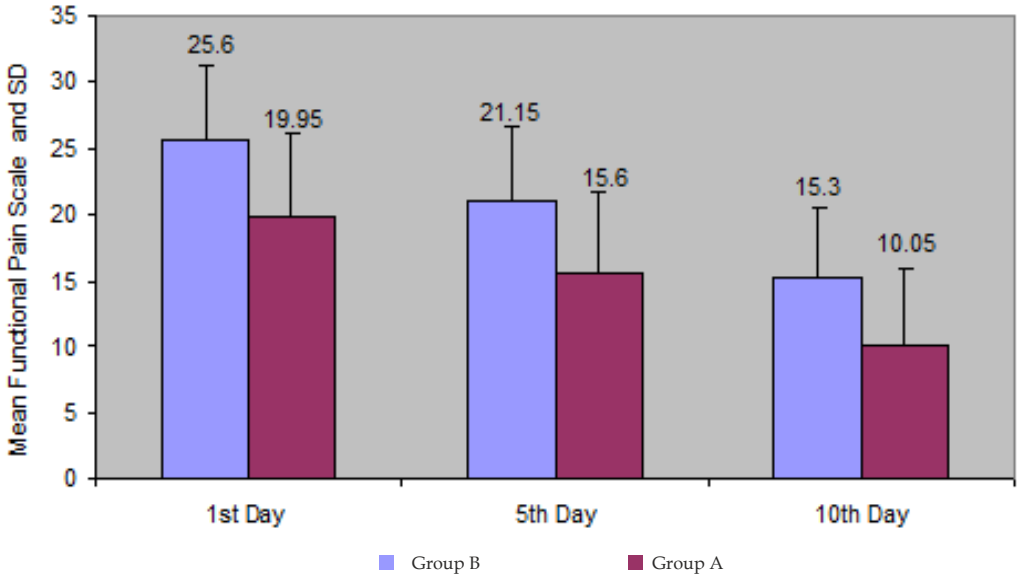


Table 8: (comparison of outcomes).

	Experimental group A			Control group B			Change			P value		
Outcome measures				1ST day	5TH day	10TH day	1ST day	5TH day	10TH day	1ST day	5TH day	10TH day
NPRS	6.45	3.75	1.50	6.80	5.15	2.60	0.35	1.40	1.10	0.300 NS	0.001 S	0.003 S
Grip Strength	24.50	24.90	25.75	23.40	23.85	23.90	1.1	1.05	1.85	0.245 NS	0.471 NS	0.036 S
Functional Status	19.95	15.60	10.05	25.60	21.15	15.30	5.65	5.55	5.25	0.005 S	0.004 S	0.005 S

a. *Age and gender distribution:* No significant difference was found in age and gender wise distribution of subjects in both the groups ($p>0.05$) Table 1.

b. *NPRS:* The mean values of pain on NPRS was taken for both the groups on 1st, 5th and 10th day of treatment session. By using 'paired t' test significant reduction in pain was found in both the groups. (Table 2 and 3).

But when control group and experimental group were compared for pain on NPRS on 1st , 5th and 10th day by using 'unpaired t' test, no significant change in pain was found at Day 1 (t=1.051, p=0.300NS) but significant change was found on 5th day (t =3.637, p= 0.001S) and 10th day (t = 3.168, p = 0.003S) (Table 8, graph 1)

The mean value of pain on NPRS in experimental group A was found less as compared to control group. Hence experimental group receiving Mulligan taping in addition with Mulligan mobilization MWM and conventional therapy is found to be more effective in reducing pain than control group B receiving MWM and conventional therapy alone.

c. *Grip strength:* The mean value of grip strength was taken for both the groups on 1st, 5th and 10th day of treatment session. By using 'paired t' test, no significant improvement was found in both the groups (Table 4 and 5)

But when control group and experimental group were compared for grip strength on 1st ,5th and 10th day by using 'unpaired t' test no significant change in grip strength was found on 1stday (t=1.81, p=0.245NS) and 5th day(t =0.728, p= 0.471NS), but significant change was found on 10th day (t = 2.173, p = 0.036 S) (Table 8, graph 2)

The mean grip strength in experimental group was found more than control group, and its improvement was significant on 10th day. Hence Mulligan taping, when given in addition with MWM and Conventional treatment is found to be more effective in increasing grip strength than MWM and Conventional treatment alone.

d. *Functional pain scale score:* The mean values of functional pain scale score were taken for both the groups on 1st, 5th and 10th day of treatment session. By using 'paired t' test. Significant decrease in functional pain scale score was found in both the groups. (Table 6 and 7)

But when control grp and experimental group were compared for functional pain scale score on 1st, 5th and 10th day by using 'unpairedt' testsignificant decrease in functional pain scale score was found on 5th day (t =3.02, p= 0.004S) and 10th day (t = 2.96, p = 0.005S) (Table 8, graph 3)

The mean Functional pain scale score in experimental group was found less as compared to control group. Hence Mulligan taping when given in addition to MWM and Conventional treatment is found to be more effective in improving functional activities of subject than MWM and Conventional treatment alone.

Discussion

Our study was carried out to compare the effect of Mulligan taping when given in addition with MWM and conventional therapy in terms of pain, grip strength and functional activities in patient with lateral epicondylitis when treated with MWM and conventional therapy alone.

In our study, chi square statistical analysis was used to compare the distribution of subjects according to the age and gender for both the groups. The paired 't' test was used for comparing effect of treatment through outcome measures within the group for both control and experimental group (intra group). Student unpaired 't' test was used to compare the statistical difference of outcome measures in between the control and experimental group (inter group), with $p<0.05$ taken as indicating statistical significance.

In our study we found that Mulligan taping when given in addition with Mulligan mobilization and conventional therapy resulted in better outcome in the patients than those treated with Mulligan mobilization and conventional therapy alone in terms of pain, grip strength and function. According to Melzack and Wall pain gate theory, stimulation of large diameter myelinated afferent neurons inhibits nociceptive afferent input at the spinal cord level. Descending pain inhibitory system also plays a role in pain inhibition.[25] Mulligan mobilization stimulates this descending pain inhibitory system thereby causing immediate pain relief. Brian Mulligan has proposed, taping techniques is effective in pain relief by maintaining the correction of the position fault thus limiting harmful movement and allowing pain free functional movement, so it prevents further injury of involved structures enhancing its healing process.[26,27] Taping has an effect on pain as cutaneous stimulation provided by the taping techniques stimulates the large mechanoreceptors thereby causing neural inhibition and decreased pain perception (Pooja Arora et al., 2012).[28]

In this study, it was found that experimental group receiving Mulligan taping had significant decrease in pain , as taping helped in maintaining

the Mulligan mobilization glide for longer time. This allowed for maintaining the correction of positional fault for longer time thereby limiting harmful movements. It also allowed pain free functional movement thereby decreasing load distribution on ECRB junction. The present study support the findings of study done by Akram Amro MPH , Ina Diener PhD, (2010)[29] which concluded that Mulligan mobilisation with movement and Mulligan taping technique gives statistically significant improvement in pain and grip strength. Present study also support the findings of Alireza Shamsoddini1, Mohammad Taghi Hollisaz, PhD. Rahmatollah Hafezi, PhD (2010)[30], which investigated the initial effect of taping technique on wrist extension and grip strength and pain of individuals with tennis elbow. The result demonstrated a significant increase in grip strength. It is proposed that possible model of the mechanism of action for diamond taping in lateral epicondylalgia relates to its neurophysiologic effects on the nervous system, particularly the nociceptive system. In this neurophysiological model the tape may exert an effect on grip strength by primarily altering pain perception, either locally at the elbow by inhibiting nociceptors, facilitating large afferent fibers input into the spinal cord and/ or possibly by stimulating endogenous processes of pain inhibition.

Limitation

Study with larger sample size is required to examine the effects in larger affected population. Also, the follow up of the patients was not taken after two weeks to assess the long-term effect of the treatment given in the subjects. The neurophysiological mechanisms thought to be responsible for the effects of MWM also need to be explored further.

Conclusion

The study concludes that Mulligan taping when applied in addition to MWM and conventional therapy gives more significant reduction in pain and improvement in grip strength and functional status than when treated with MWM and conventional therapy alone in patients with lateral epicondylitis.

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Original Article

Physiotherapy and Occupational Therapy Journal
Volume 13 Number 3, July- September 2020
DOI: http://dx.doi.org/10.21088/potj.0974.5777.13320.9

Comparison of Peak Expiratory Flow Rate of Citizens of Delhi and Jaipur Due to Pollution

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How to cite this article:
Vivek Singh, Davinder Kumar Gaur. Comparison of Peak Expiratory Flow Rate of Citizens of Delhi and Jaipur Due to Pollution. Physiotherapy and Occupational Therapy Journal. 2020;13(3):133-140.

Abstract

Introduction: The effects of air pollution include breathing and respiratory problems, aggravation of existing disease and alterations in the body defense systems against foreign materials. Peak flow readings are higher when we are well, and lower when the airways are constricted. From changes in recorded values, we may determine lung functionality, severity of asthma symptoms, and treatment options. The was aimed to establish normal values of PEFR in people, to find out the correlation of pollution parameters with PEFR.

Methodology: 100 subjects (50 from Delhi and 50 from Jaipur) were involved in the research, after having detailed history of occupation and pulmonary diseases to exclude the subjects having any threat of pulmonary restriction. BMI was calculated. Command was given subject to expire in the peak flow meter fast and hard as he/she can. 3 PEFR values were taken and maximum value were noted.

Results: PEFR value is highly significant and comparable and other factors are not significant as all other factors of both the cities were same.

Conclusion: PEFR Delhi is less than PEFR Jaipur. It can be said that it because of the increased air pollution in new Delhi as compared to the Jaipur.

Keywords: PEFR-peak expiratory flow meter; pollution; BMI.

Introduction

Clean air is what all living humans and animals needs for good health and well-being. However, due to unstoppable urban development, the air is continuously polluted. Urban ambient air is more polluted than overall atmosphere, due to high density of human population and their activities in urban areas; it produces air pollutants with a higher rate as compared to less-developed areas and natural environment.

Air pollution is physical or chemical changes brought about by natural processes or human activities that result in air quality degradation. The release of large amounts of smoke and other forms of waste into the air caused an unhealthy condition because the pollutants were released faster than they could be absorbed and dispersed by the atmosphere.[1]

In urban areas vehicular pollution is predominant and significantly contributes to air quality problems. Road traffic produce volatile organic compounds, suspended particulate matter (SPM), oxides of sulphur (SOx), oxides of nitrogen (NOx), and carbon monoxide (CO), which makes adverse health effects on the exposed population. The particles emitted from the vehicular exhaust of more than 10-micron size are held in upper respiratory tract and particles less than 10-micron size (PM10) accumulates in the lung and produces respiratory abnormalities. The effects of air pollution include breathing and respiratory problems, aggravation of

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existing disease and alterations in the body defence systems against foreign materials, damage to lung tissue, carcinogenesis and premature death.[2]

Peak expiratory flow rate is the maximal expiratory flow rate sustained by a subject for at least 10 milliseconds expressed in Litre per minute (L/min). PEFR had been used as measurement of ventilatory capacity for long since mainly because of a much simpler and less tiring procedure than maximum voluntary ventilation (MVV), single forced expiration in a simplified device min-Wright peak flow meter is now required and easily available for measurement of its value.[3]

Many researches have shown the peak flow meter use in clinical practice. A peak flow meter is a small hand-held device that measures how fast a person can blow air out of the lungs when there is forceful exhalation, after maximum inhalation. This measurement is called the 'peak expiratory flow' (PEF). The peak flow meter helps to assess the airflow through the airways and thus help to determine the degree of obstruction along them. The measurement of PEF was pioneered by Dr Martin Wright who produced the first meter specifically designed to measure this index of lung function. Since the original design was introduced in the late 1950s, and the subsequent development of a more portable, lower-cost version (the 'Mini-Wright' peak flow meter), other designs and copies have become available across the world. Brands of electronic peak flow meters are also being marketed.

Types of peak flow meters

There are several brands of peak flow meters available which all perform the same function. However, there are two major types: the low-range peak flow meter for small children between 4 and 9 years of age, and for adults with severely impaired lung function; and the standard-range peak flow meter for older children, teenagers, and adults. It is important that the doctor or healthcare provider prescribes the appropriate device for each individual. Adults have larger airways than children. If given a low-range peak flow meter, they will continually have maximum peak flow rates even when having severe shortness of breath. This may jeopardize proper management; they therefore need the much larger standard range.[4]

are higher when we are well, and lower when the airway routes are contracted. From changes in recorded qualities, we may decide lung usefulness, seriousness of asthma indications, and treatment alternatives.

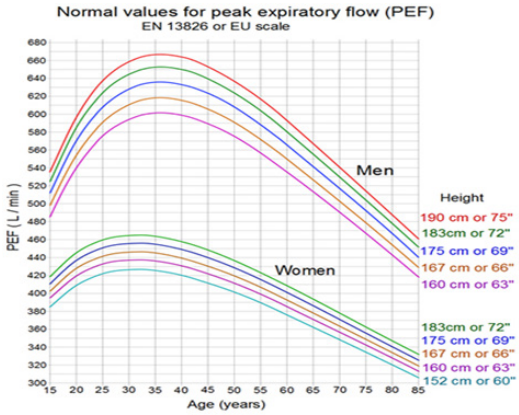


Fig. 1: Normal values for peak expiratory flow (PEF) EN 13826 or EU scale

Fig. 2: Peak Flow Meter.

Fig. 3: Mouth Peice.

Fig. 4: Subject performing expiration in PEFM

Estimation of PEFR requires some training to effectively utilize a meter and the typical expected worth relies upon a patient's sex, age and stature (figure 1). It is traditionally decreased in obstructive lung problems, for example, Asthma, COPD or Cystic Fibrosis.

Peak flow readings are regularly ordered into 3 zones of estimation as indicated by the American Lung Association; green, yellow, and red. Specialists and wellbeing professionals create the board plans dependent on the green-yellow-red zones..

Green Zone: 80 to 100 percent of the usual or normal peak flow readings are clear. A peak flow reading in the green zone indicates that the lung function management is under good control.

Yellow Zone: 50 to 79 percent of the usual or normal peak flow readings indicates caution. It may mean respiratory airways are narrowing and additional medication may be required.

Red Zone: Less than 50 percent of the usual or normal peak flow readings. Indicates a medical emergency. Severe airway narrowing may be occurring and immediate action needs to be taken. This would usually involve contacting a doctor or hospital.[5]

Materials and Methods

A prospective cross-sectional study design with 2 different groups from New Delhi and Jaipur were studied. The study was carried out in 2 different cities [Jaipur and New Delhi] in and around educational institutions.

The study protocol was approved by Institutional Ethical Committee of BCIP COLLEGE, kalkaji. 180 subjects population was observed in the study out of which 30 subjects withdrawn voluntarily and 50 subjects were excluded on bases of exclusion criteria. Both male and femaleSubjects without any history of chest infection or any chronic pulmonary disease were included in the study. Subjects below 5 years and a bove 60 years, any known case of asthma or chronic lung disease, smokers, H/O respiratory illness within week prior to study, Any other medical illness or Thoracic deformity were excluded in the study. Instruments used in study were Peak flow meter and standard Weighing machine.

Peak expiratory flow rate (PEFR), Height, Wight and Body Mass Index were measured as outcome for data recording in both the groups.

How to use

Peak flow meter: The purpose and procedure of the test should be explained to the subject followed by a demonstration of its performance. Individual ought to play out the test in standing position holding the peak flow meter evenly without meddling with the development of the marker (bolt) or covering the opening. The individual ought to request to take full breath at that point breathe out it by intense termination as quick as conceivable subsequent to keeping up impermeable seal among lip and mouth bit of the instrument. Perusing should be taken keeping the instrument level position (figure 4).

Procedure

100 subjects fulfilling the criteria belonging to respective states with 50 from Delhi and 50 from Jaipur were studied in the research including both males and females(graph 1), after having detailed history of occupation and pulmonary diseases to exclude the subjects having any threat of pulmonary restriction. Aim of the study was informed to check the PEFR levels of 2 cities to compare and proving the harm of pollution. Subjects were informed for further physical examination (height, weight measuring and BMI calculation). As a pre-test assessment, parental history, subject examination and the subject's history was taken to rule out if the subject was normal or having history of any present or past illness. History was taken to exclude the subjects as per the excluding criteria.

On the data collection day, the subject was asked quOn the data collection day, the subject was asked questioned related to their past and present illness and demographic data including the name, sex, age, address and occupation prior to commencement of data collection procedure. Height, weight, BMI, resting heart rate and PEFR were noted. Subject was explained the procedure to use the peak flow meter. Command was given subject to expire in the peak flow meter fast and hard as he/she can. 3 PEFR values were taken simultaneously and maximum value were noted (Figure 1,2,3 & 4).

Data analysis: Data was analyzed using SPSS, 2 tailed t test was used for both groups to allow an equal likelihood for finding significant differences between subjects of Delhi and Jaipur. Correlation was used to correlate between the all the factors of the collected data.

Results and Discussion

Total 100 subjects were selected for data collection,50 from Delhi and 50 from Jaipur. All subjects were normal without having any respiratory disease. P

value - statistically significant as P < 0.05 and statistically highly significant as P < 0.001 were considered. Age- p value wss greater than 0.05 , BMI- p value wss greater Than 0.05, PEFR- P value was less than 0.01, it was highly significant (Table 1 and Graph 1).

Table 1: Sample distribution statistics of age, height, weight, BMI and PERF max

T TEST

	Group Statistics					
	Place	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**P-value**
Age	Delhi	50	25.40	8.619	1.219	.785
	Jaipur	50	24.94	8.215	1.162	
Height	Delhi	50	168.620	9.0658	1.2821	.035
	Jaipur	50	164.720	9.2119	1.3028	
Weight	Delhi	50	63.616	13.1801	1.8640	.220
	Jaipur	50	60.560	11.5160	1.6286	
PEFR max	Delhi	50	459.00	81.947	11.589	.005
	Jaipur	50	502.40	69.033	9.763	
BMI	Delhi	50	22.446000	4.0100491	.5671066	.714
	Jaipur	50	22.184000	3.0474051	.4309682	

Table 2: Correlation statistics for subjects in Delhi

		Age	**Height**	**Weight**	**PEFR Max**	**BMI**
Age	Pearson Correlation	1	.212	.294*	.088	.266
	Sig. (2-tailed)		.139	.038	.543	.062
	N	50	50	50	50	50
Height	Pearson Correlation	.212	1	.594**	.571**	.152
	Sig. (2-tailed)	.139		.000	.000	.292
	N	50	50	50	50	50
Weight	Pearson Correlation	.294*	.594**	1	.423**	.872**
	Sig. (2-tailed)	.038	.000		.002	.000
	N	50	50	50	50	50
PEFR Max	Pearson Correlation	.088	.571**	.423**	1	.171
	Sig. (2-tailed)	.543	.000	.002		.234
	N	50	50	50	50	50
BMI	Pearson Correlation	.266	.152	.872**	.171	1
	Sig. (2-tailed)	.062	.292	.000	.234	
	N	50	50	50	50	50

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3: Correlation Statisticsforsubjectsin Jaipur

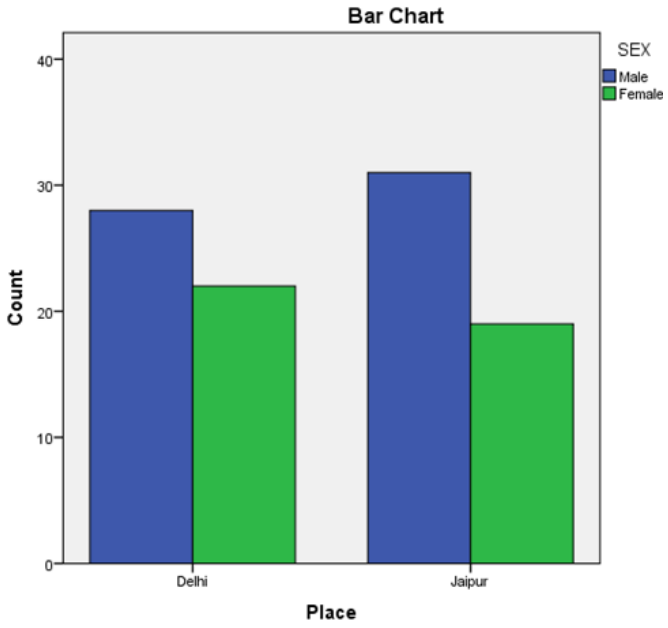
	Age	**Height**	**Weight**	**PEFR Max**	**BMI**	
Age	Pearson Correlation	1	.114	.318*	.226	.334*
	Sig. (2-tailed)		.429	.024	.115	.018
	N	50	50	50	50	50
Height	Pearson Correlation	.114	1	.728**	.566**	.213
	Sig. (2-tailed)	.429		.000	.000	.137
	N	50	50	50	50	50
Weight	Pearson Correlation	.318*	.728**	1	.512**	.820**
	Sig. (2-tailed)	.024	.000		.000	.000
	N	50	50	50	50	50
PEFR Max	Pearson Correlation	.226	.566**	.512**	1	.275
	Sig. (2-tailed)	.115	.000	.000		.053
	N	50	50	50	50	50

BMI	Pearson Correlation	.334*	.213	.820**	.275	1
	Sig. (2-tailed)	.018	.137	.000	.053	
	N	50	50	50	50	50

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Graph 1: Gender distribution statistics in studied population



Pollution Levels

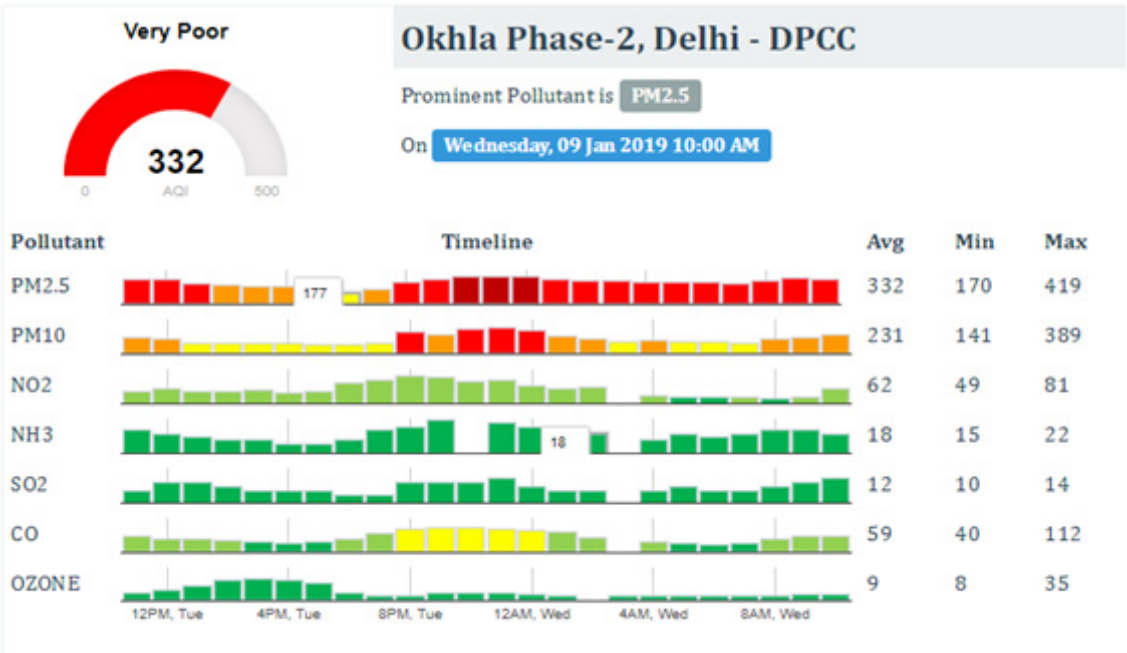


Fig. 5A: Pollution Levels in Delhi and Jaipur at the time of research

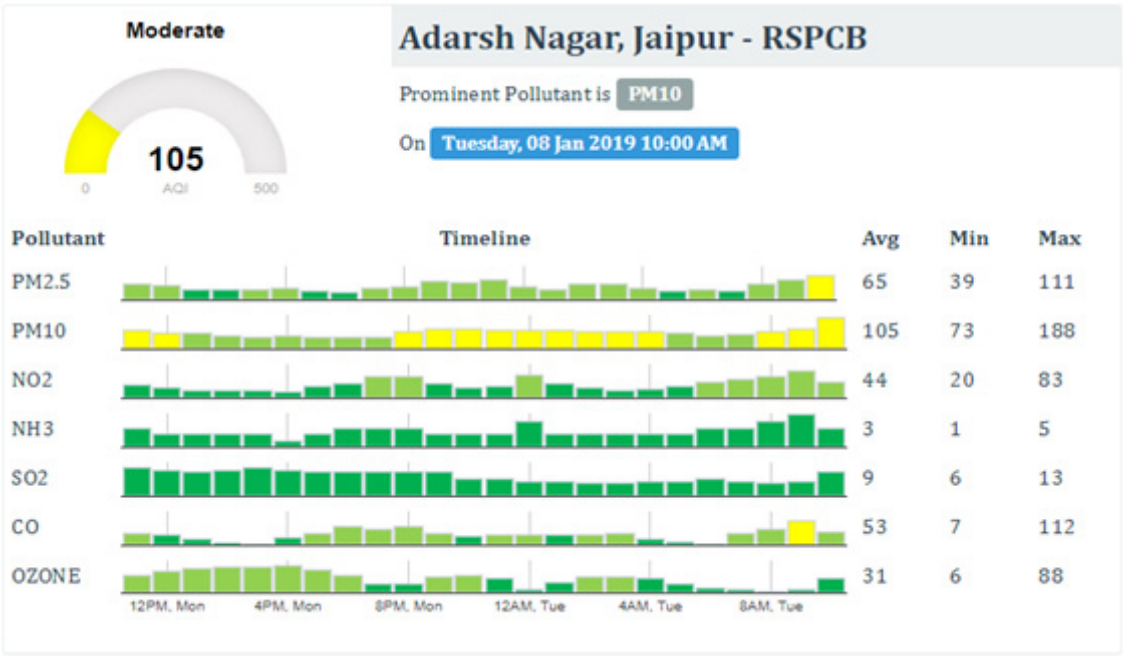


Fig. 5B: Pollution levels in Delhi and jaipur at the time of research

AQI	Remark	Color Code	Possible Health Impacts
0-50	Good		Minimal impact
51-100	Satisfactory		Minor breathing discomfort to sensitive people
101-200	Moderate		Breathing discomfort to the people with lungs, asthma and heart diseases
201-300	Poor		Breathing discomfort to most people on prolonged exposure
301-400	Very Poor		Respiratory illness on prolonged exposure
401-500	Severe		Affects healthy people and seriously impacts those with existing diseases

Fig. 6: Source-National Air Quality Index https://app.cpcbccr.com/AQI_India/#.[6]

Analysis of data revealed that PEFR of Delhi subjects was less than PEFR of Jaipur subjects. It may be said that the difference obtained in PEFR was because of the increased air pollution in new Delhi as compared to the Jaipur.

Discussion

Air contamination is a most significant issue of the current time everywhere on the world particularly in the huge urban communities due to the enormous degree of industrialization. The arrival of such air contaminations in weighty focuses, for example, brown haze, particulates, strong materials, and so on are getting settled over the city, causing air contamination and wellbeing dangers to the individuals. Loads of messy squanders delivered by individuals on regular schedule particularly in the enormous urban areas dirtying the entire climatic air generally .

The arrival of vaporous poisons from consuming fuel of engine vehicles, modern cycles, consuming of trash, and so on are adding to the air contamination. Some common toxins like dust, dust, soil particles, flammable gases, and so forth are additionally the wellspring of air contamination.

Delhi has a high number of naturally well-disposed CNG-run transports. Notwithstanding this, the air contamination because of vehicular outflow is enormous. It is a result of the diminished green cover over Delhi. The previous twenty years have seen an uncontrolled development of land everywhere on the city. Impact of air pollution on morbidity and mortality increases with the exposure levels but there are no thresholds below which the adverse effects of the pollution do not

occur. Therefore, the mortality and morbidity is increased by the pollution in all parts of the world, but at least half of the disease burden is borne by the populations of developing countries. People with existing cardiac or pulmonary disease are at increased risk of acute symptoms or mortality.

Long-term exposure to combustion-related fine particulate air pollution is an important environmental risk factor for cardiac, pulmonary and lung cancer mortality.[7]

In metropolitan territories vehicular contamination is dominating and essentially adds to air quality issues. Street traffic produce unstable natural mixes, suspended particulate issue (SPM), oxides of sulfur (SOx), oxides of nitrogen (NOx), and carbon monoxide (CO), which makes antagonistic wellbeing consequences for the uncovered populace (Fig. 5 a&b and 6). The particles transmitted from the vehicular fumes of more than 10-micron size are held in upper respiratory lot and particles under 10-micron size (PM10) gathers in the lung and produces respiratory irregularities. The impacts of air contamination incorporate breathing and respiratory issues, irritation of existing sickness and changes in the body safeguard frameworks against unfamiliar materials, harm to lung tissue, carcinogenesis and unexpected passing.[2]

The PEFR is one among the lung work test which is useful in assessing obstructive lung infections particularly bronchial asthma. It is likewise useful in checking the infection movement and reaction to treatment. The Peak Expiratory Flow Rate (PEFR) is an exertion subordinate boundary, arising out of the huge aviation routes inside around 100-120 msec of the beginning of constrained termination. It stays at its top for 10 msec . It is all around recorded in writing that a wide scope of geological, climatic, anthropometric, healthful, and financial states of India are related with provincial contrasts in lung work. Other than anthropometric and financial components, height is a significant determinant of lung work.[8]

Many research has shown the effect on PEFR due to pollution. There is a marked decrease in PEFR value due to respiratory problems caused by pollution. Aritra Sanyal and Lalit H. Nikam conducted research on effect of air pollution on peak expiratory flow in taxi drivers and train drivers and they concluded that Air pollution is affecting the lung function of every individual in this world and the decreased lung function is directly proportional to the amount of time the person is spending in the polluted air. As taxi drivers spend major part of their day in polluted air, their lung function had decreased more compared to the local train drivers, who don't have to spend that much time in the polluted air, because their job is restricted to a particular corridor where dust & fumes of other vehicles are comparatively less.[9]

This research was aimed to find the difference between the PEFR levels of citizens of two different cities (Delhi and Jaipur) as there are different pollution levels in both the cities, Delhi has a higher pollution level causing respiratory problems and breathing problems due to excessive vehicular and industrial pollution whereas Jaipur has very low pollution levels as compared to Delhi (Fig. 5 and 6).

Therefore the result of the data collected shown that PEFR Delhi was less than PEFR Jaipur. This may be because of the increased air pollution in New Delhi as compared to the Jaipur which inturn indicates towards declining health of the population at risk in the studied area.

Conclusion

The study concludes that there may be a correlation between pollution and PEFR values of both the cities. On the basis of the results found in present study, it may be concluded that "There is a significant difference of PEFR among normal young adults of Delhi and Jaipur, without any history of respiratory disorder".

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